THE U.S. NAVAL OBSERVATORY

STAR

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The Captain's Corner

CAPT Ben Jaramillo, Superintendent

Where has the time gone? It is hard to believe that I have been the Superintendent for over a year now. I must say that it has been a very interesting and rewarding year for me and I look forward to my second year.

A lot has happened since the last edition of the STAR. We have a new President and a new Vice President as a neighbor, we hosted a highly successful Sixth Annual Astrometry Forum and we continue to receive numerous well-deserved accolades for the grand millennium celebration on 31 Dec 2000. Along with those major events, you have all been extremely busy doing the work of the USNO and keeping us a world class leader in what we do best. Your dedication and hard work have been noticed by many and I want to add my thank you for your continued support.

With the sun shining bright, temperatures in the 60s (finally) and tree buds everywhere, I am sure thoughts of spring and warmer weather are in our minds. As we start our march towards spring, I ask all of you to look around your workspaces and on the USNO grounds and keep an eye out for areas where we need to do repairs, refurbishing or just general cleaning. The Deputy is working on a plan for a major removal of excess equipment from our buildings to include the main building basement. This will be an excellent time to start our spring cleaning here at USNO. Your valued assistance will greatly enhance any effort we go to in cleaning up and sprucing up the grounds in time for the spring and summer.

I look forward to seeing each and every one of you again as my schedule and warmer weather permits me to be out and about. Keep up the hard work and I will continue to try and make this the best place to work. See you around the grounds and especially at the upcoming Navy-Marine Corps Relief Society Car Wash and the USNO Open House!

USNO Celebrates New Millennium With Open House and Time Ball Drop

On New Year's Eve, December 31, 2000, USNO celebrated the beginning of the Third Millennium under the stars with a free Open House and a gala reception hosted by Secretary of the Navy the Honorable Richard Danzig, Oceanographer of the Navy RADM Richard West, and USNO Superintendent CAPT Ben Jaramillo. Some 700 formally-attired guests at the reception joined about 3000 members of the general public to ring in the Millennium with the dropping of the Millennial Time Ball at the stroke of midnight. This was followed by a 15-minute fireworks show sponsored by corporate donors to the Navy League of the United States National Capital Council.

The gala reception featured music provided by the U.S. Navy Band's "Country Current" in a large tent erected on the patio of Building 56. A string quartet provided softer music in the large conference room, and a Celtic group featuring local artists Grace Griffith and Connemara entertained the public in the lobby of Building 1. Displays from NAVSEA, NRL, EOD, United Defense, and Lockheed Martin

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highlighted the theme of the event as the Navy looks toward the 21st Century.

About 300 visitors enjoyed a rare opportunity to look at Jupiter and Saturn through the historic 26-inch refractor. Another half-dozen telescopes, provided by members of the Northern Virginia Astronomy Club, National Capital Astronomers, Inc., and the Westminster Astronomical Society were on hand to show celestial sights in the crisp and cold New Year's Eve skies.

Pictures of this year's event may be found on page X.

USNO Sailor first to re-enlist in the Third Millennium

IC1(SW) Jerry Carrillo became the first sailor in the U.S. Navy to re-enlist in the Third Millennium in a ceremony conducted in the USNO Library shortly after Midnight, 1 January 2001. The Oath of re-enlistment was administered by Secretary of the Navy the Honorable Richard Danzig.

Jerry has worked in the IT Department for 3 years. He has served in the Navy for 17 years. This is his third re-enlistment, and will certainly be his most memorable! Congratulations, Jerry!

SECNAV Richard Danzig administers the Oath of re-enlistment to IC1 Jerry Carrillo in the USNO Library shortly after midnight, 1 January 2001.

Perry Award Presented to GPS Team

The Precision Strike Association presented its annual William J. Perry Award to the NAVSTAR GPS Joint Program Office and the nationwide GPS team in a ceremony in Crystal City on 17 January 2001. The award recognizes "superb contributions to precision strike systems" and was "established to recognize public or private sector leadership or technical achievement that results in significant contributions to the development, introduction, or support of precision strike systems. The recipient must have made significant contributions that have led to the strengthening of our national security by direct application of precision strike capabilities to DoD systems and/or to the enhancement of our industrial technology base of application to precise strike technology.

The GPS Team includes the JPO, along with USNO and NRL. USNO's precise time technology was recognized as a major factor in the success of the nationwide team.

An Adventure in "QuickCam" Astronomy

By Geoff Chester

I've been interested in astrophotography since that night some 35 years ago when I hand-held my Dad's Topcon SLR up to the eyepiece of my Tasco 4.5-inch reflector and snapped some pictures of the Moon. The fact that they turned out at all was nothing short of a miracle in my mind. This experience led to a continuing interest in photography that has evolved side-by-side with my interest in astronomy.

I've kept up my interest in astrophotography over the years, accumulating a few items to help facilitate the process. However, I have also learned that a real

commitment to the art involves a fairly large outlay of cash and time, neither of which are particularly abundant these days.

The idea of digital imaging has always grated on my "purist" conventional photo side, but over the past several years I have to admit that the quality of digital work, especially in lunar and planetary imaging, has really taken off. So it was only natural that I began to think of some way to get into this field.

A quick scan of any *Sky & Telescope* issue these days will certainly when the appetite of a potential digital imager, but a check on the ads for the most popular cameras will bring reality crashing down on anybody with a tight budget...until now.

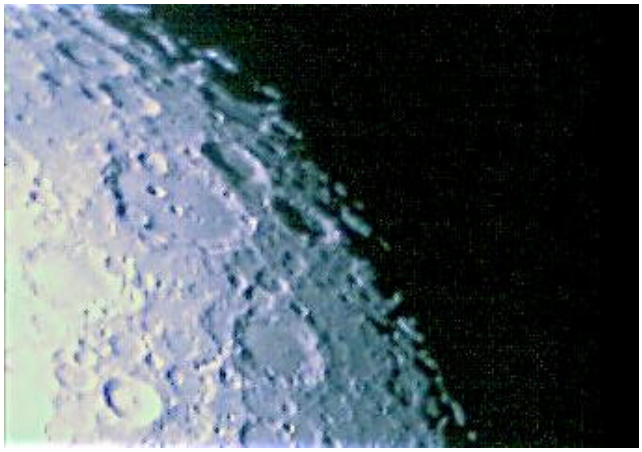
An article in the June 1998 issue of *Sky & Telescope* caught my eye as I was leafing through some back issues. "QuickCam Astronomy" by John Buchanan showed some very impressive lunar and planetary images taken with a $50 Connectix black & white QuickCam, one of the first-generation "webcams". With a little judicious hacking (warning: cracking the case voids the warranty!), Buchanan had a CCD camera based on the popular Texas Instruments TI245 chip at a very reasonable price.

A trip to the local computer superstore found me returning home with a $40 Logitech QuickCam Express, a color USB web-cam with a 320 X 240 X 10-micron CMOS imager chip and software to control it.

Buchanan hacked his QuickCam pretty extensively, removing the PCB from its cute little round case and re-mounting it in the top of an Edge shaving cream can. I didn't want to get too surgical, so I simply unscrewed the lens assembly from mine and hot-glued a Kodak 35mm film can (with its bottom cut out) to the round case.

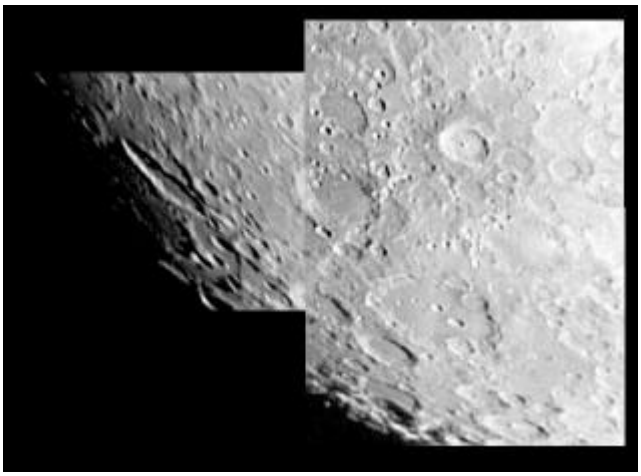
It took all of 10 minutes to modify, and as soon as the glue was dry I toddled the camera, my laptop, and my 8-inch Dobsonian (Ol' Blue Eye) out to the front yard for a few test shots.

The Moon was peeking through sucker holes in the clouds, but despite this I was able to get a couple of shots. This is the first one:



By this time I'd found a very good web site, the QCUIAG (QuickCam and Unconventional Imaging Astronomy Group), http://www.astrabio.demon.co.uk/QCUIAG/. This led to a small freeware application called AstroStack, which I used to combine several frames, the results of which can be seen in the next picture. This image shows a "raw" frame of the crater Gassendi (left), along with a processed image made from a stack of 6 frames processed with a sharpening mask for 3 iterations.

This, in turn, led to a mosaic of the southern lunar highlands. This mosaic is made from 3 images (6 frames each, processed as above with AstroStack) pieced together using PaintShop Pro.



Over the ensuing weeks I imaged double stars, sunspots, and the planets with the modified QuickCam, with varying degrees of satisfaction. My first planetary attempts were encouraging, but not much better than what I had achieved with conventional photography. However, the near "instant gratification" I was getting by seeing my images captured on the laptop screen was infectious.

I soon found that the CMOS chip in the QuickCam Express lacked low light sensitivity for possible deep-sky imagery and small pixel size, but the Philips Vesta cameras had a much more sensitive 640 x 480 x 5.6-micron CCD. Some of the planetary results with this camera were pretty amazing. Sylvain Weiller, a French member of the OQUIAG, had used this cam and a C-8 to get these images of Jupiter and Saturn. This gave me a goal to shoot for...

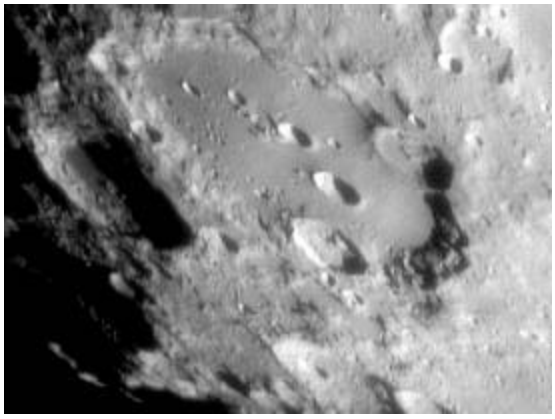
Saturn & Jupiter by S. Weiler

In mid-October I purchased a Philips Vesta 675K webcam and modified it as above (film can and hot glue), and the QuickCam Express was subsequently hacked back into an ordinary Web cam. "First light" on the Vesta was (auspiciously?) Friday the 13th. I stayed out until nearly 2 in the morning, then stayed up another hour processing the images. Frankly, I was stunned. I'd never seen detail *visually* like that before through a Schmidt-Cassegrain telescope!

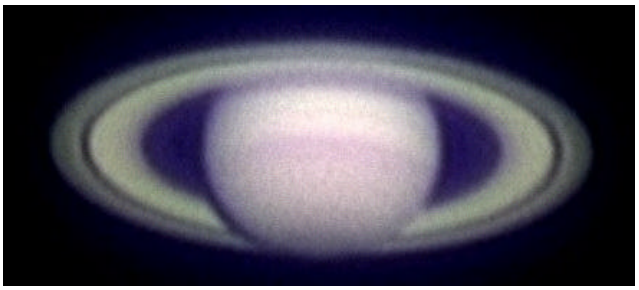
Jupiter (with Ganymede), 10/14/00, 0506 UTC
and
Saturn, 10/14/00, 0450 UTC
Images acquired with Philips 675K web cam and Vega 1.2 software
on Celestar-8 telescope with 2.5X TeleVue Barlow Lens.

Over the course of the next few months, I used the camera to image the Moon, planets, and bright double stars using a variety of instruments. During one of these sessions, my first on the USNO 26-inch refractor, I accidentally brushed the camera with an errant elbow, breaking the seal between the film can and the camera and sending the latter crashing to the floor. Somehow it survived the trauma and I have made a new adapter using the drilled-out lens assembly of the camera and another film can, which now screws into the threaded end of the camera's

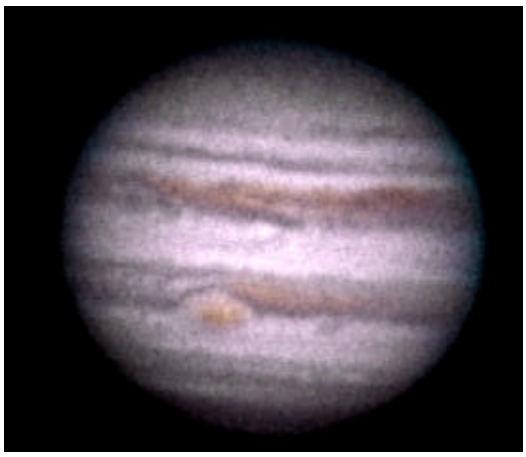
body. Here are some representative images from some of these sessions.



Lunar Crater Clavius, imaged with the USNO 12-inch Clark refractor and 2X Barlow Lens.



Saturn, imaged through the USNO 26-inch refractor, 13 January 2001, 01:38 UTC.



Jupiter, imaged through Celestar-8 Schmidt-Cassegrain telescope with 2.5X Barlow Lens, 3 December 2000, 03:15 UTC.

The quality of these images has finally convinced me that my days of photographing the planets by conventional means are over. In addition to lunar and planetary imaging, I am now in the process of compiling an image catalog of the 100 double- and multiple-star systems in the Astronomical League's Double Star Club, and am also looking at the feasibility of imaging geostationary satellites.

The possibilities seem endless, and it looks like many cheerful hours will be spent at the telescope for some time to come.

Security Notes

USNO POLICE EMERGENCY NUMBERS

34th Street Gate (24 Hours): 762-1468

Shift Lieutenant: 762-0336

Shift Sergeant: 762-0338

Local Emergency Number: Dial 99 + 911.

When calling the local emergency number please notify the USNO police in order to escort the emergency personnel and vehicles to the scene.

GATES (Hours of Operation):

34th Street Gate: Open 24 Hours/7 Days Per Week

South Gate: Open Monday through Friday, 0545 - 1830

Wisconsin Gate: Closed until further notice

Davis Street Gate: Closed

Gilliss Avenue Gate: Opened as Directed, otherwise closed

Wisconsin Turnstile: 24 Hours Daily (Must have USNO Swipe Card to re-enter)

USNO In The News

Geoff Chester, Public Affairs

USNO received plenty of "indirect" publicity during the month following the national election. At one time there were about a dozen TV remote trucks parked along Massachusetts Avenue, 34th Street, and Observatory Circle.

The "Antenna Farm" sprouting along Observatory Circle, December, 2000

The "true" beginning of the Third Millennium kept the USNO Public Affairs office busy during the last two weeks of December. Steve Dick and Geoff Chester were interviewed by each of the major broadcast and cable TV news networks, all of the local broadcast TV stations, and an almost innumerable stream of radio and newspaper correspondents. The culmination of this flurry was an appearance by Geoff on the NBC News *Today* program, in a live interview in front of the 34th Street anchor and Millennium Countdown Clock.

The New Year's Eve Open House was covered by ABC, CBS, and Fox national news, while local NBC affiliate sent a crew for their evening newscast.

Film crews from German Television and RAI Italian TV spent some time at the Observatory documenting the USNO's role in precise timekeeping and the development of the Cesium Fountain. These segments will air in science-news digest programs in Europe this spring.

ABSTRACTS OF RECENT PAPERS:

SPECKLE INTERFEROMETRY AT THE U.S. NAVAL OBSERVATORY, V.

Geoffrey G. Douglass, Brian D. Mason, Theodore J. Rafferty, Ellis R. Holdenried, and Marvin E. Germain

The Astronomical Journal, Vol. 119, Pg. 3071, June 2000

The results of 1,544 speckle-interferometric observations of 637 binary stars, ranging in separation from 0.25 to 5.25 arcseconds, are tabulated. These observations were obtained using the 66-cm refractor at the U. S. Naval Observatory in Washington, D.C., with an intensified CCD (ICCD) detector. This is the fifth in a series of papers presenting measures obtained with this system, and covers the period January 1, 1998 through December 31, 1998. Random errors for all measures are estimated to be 17.6 mas in separation, and 0.55/p in position angle, where p is the separation in arcseconds.

SPECKLE INTERFEROMETRY AT THE U.S. NAVAL OBSERVATORY, VI.

Brian D. Mason, William I. Hartkopf, Ellis R. Holdenried, Theodore J. Rafferty, Gary L. Wycoff, Greg S. Hennessy, David M. Hall, Sean E. Urban, Thomas E. Corbin

The Astronomical Journal, Vol. 120, Pg. 1120, August 2000

The results of 1068 speckle-interferometric observations of double stars, made with the 26-inch (0.66-m) refractor of the U.S. Naval Observatory, are presented. These observations are averaged into 841 means of 815 binary stars. The systems range in

separation from 0.22" to 6.01 with a mean separation of 2.21" and have a limiting secondary magnitude of V = 12.5. This is the sixth in a series of papers presenting measures obtained with this system, and covers the period January 1, 1999 through January 9, 2000.

USNO ALTERNATE MASTER CLOCK STEERING

Steven T. Hutsell
USNO Alternate Master Clock
400 O'Malley Avenue, Suite 44
Schriever AFB, CO 80912-4044

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34 Tozer Road
Beverly, MA 01915

The primary mission of the United States Naval Observatory (USNO) Alternate Master Clock facility (AMC), located at Schriever AFB, is to back up the critical functions of the USNO Time Service Department in Washington, D.C. The AMC operates two Master Clocks, AMC#1 and AMC#2. Each one of these [Alternate] Master Clocks is ready to function as the nation's source for precise time, UTC(USNO), should the need arise. This paper will summarize the current status of, and strategies used for, the steering of these Alternate Master Clocks. The various AMC steering strategies utilize clock comparisons from Two-Way Satellite Time Transfer (TWSTT), GPS Common View (CV), and AMC Timescale data. All current Alternate Master Clock steering strategies employ a combination of Kalman filtering and second-order control, first introduced into USNO operations in 1995. The respective designs for these steering strategies are based on several factors, including goals for synchronization and stability, as well as the desire for robustness and simplicity of operation. This paper will analyze the performance of these respective designs.

A CATALOG OF FAINT REFERENCE STARS IN 398 FIELDS OF EXTRAGALACTIC RADIO REFERENCE FRAME SOURCES

Chr. de Vegt, Hamburger Sternwarte, University of Hamburg, Germany;

R.Hindsley, N.Zacharias, L.Winter (NRL, USNO, USRA)

Accepted for publication in *The Astronomical Journal.*

Positions of 89,422 stars in 398 fields of extragalactic reference frame sources have been determined using the Hamburg Zone Astrograph (Northern Hemisphere) and the US Naval Observatory Twin Astrograph, then stationed at the Black Birch Astrometric Observatory (BBAO), New Zealand (Southern Hemisphere). Most stars are in the magnitude range 12 <= V <= 14 and the positions are accurate to about 50 mas per coordinate at the epoch of observation, which ranges from the beginning of 1976 to the end of 1991. The catalog (ERLcat) is available on-line from USNO. (http://ad.usno.navy.mil)

Moon mosaic, 5 October 2000, made with Celestar-8 Schmidt-Cassegrain telescope and Logitech QuickCam Express CMOS Web Cam.

USNO
H*A*P*P*E*N*I*N*G*S

The Real Millennium Deal:
USNO Celebrates Y2K + 1

USNO Superintendent CAPT Ben Jaramillo presents the Millennium Celebration Plaque to SECNAV Richard Danzig during official remarks at the Millennium Gala.

Oceanographer of the Navy RADM Richard West, SECNAV Danzig, and CAPT Jaramillo prepare to cut the cake shortly before midnight at the gala.

USNO Scientific Director Ken Johnston enjoying the festivities.

USNO
H*A*P*P*E*N*I*N*G*S

The Real Millennium Deal:
USNO Celebrates Y2K + 1

All eyes are on the Time Ball as midnight approaches....

HAPPY NEW YEAR !!

The U.S. Naval Observatory *Star*
U.S. Naval Observatory, Washington, D.C.

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